DIAGNOSTIC SYSTEM FOR A MODULAR FIELDBUS BOARD

This invention relates to a diagnostic system for a modular fieldbus board, for use particularly to monitor fieldbus physical layer characteristics on a modular fieldbus board carrying a number of fieldbuses.

Therefore, according to the present invention a diagnostic system for a modular fieldbus board carrying a number of fieldbuses connected to a bulk power supply, comprises a monitoring transceiver means connected in use to one or more of the number of fieldbuses by means of two or more common mode and/or differential mode signal injection and/or signal detection points, which points are dispersed between the bulk power supply and the fieldbus trunk, such that the monitoring transceiver means can detect one or more fieldbus physical layer characteristics between two of the two or more of said points.

Preferably the fieldbus physical layer characteristics which are monitored comprise one or more of: over/under termination, noise/ripple level, signal level, signal bias, signal jitter, signal ringing, signal distortion, signal attenuation, cross talk, unbalance, and earth leakage.

In a preferred construction the monitoring transceiver means can also detect one or more characteristics of hardware carried on the modular fieldbus board by means of one or more of said points. The hardware can be the bulk power supply connections, power supply converters, power supply conditioners and the fieldbus trunks. The characteristics to be monitored can comprise one or more of: voltage, short circuit, hardware module failure, quiescent current, and rate of charge.

The monitoring transceiver means can also be adapted to gather received data and produce one or more of: Fourier analysis, trending analysis, and data logging.

Preferably the monitoring transceiver means may be adapted to provide an alarm in the event that received data indicates one or more of pre-determined failures or the one or more fieldbuses.

In one construction the monitoring transceiver means can be provided with a first digital and/or an analogue interface, such that diagnostic data detected and/or alarms created by the monitoring transceiver means in use are transmitted to a digital or analogue device operated by a user, and such that commands can be sent in use from the user operated digital or analogue device to operate the monitoring transceiver means.

Alternatively, or in addition to the first interface, the monitoring transceiver means can be provided with visual means adapted to display diagnostic data detected and/or alarms created.

In addition, the monitoring transceiver means can be provided with a second digital and/or an analogue interface, such that diagnostic data detected and/or alarms created by the monitoring transceiver means in use can be transmitted to other associated diagnostic systems.

Preferably the monitoring transceiver means can be removable from the fieldbus board, and it can be powered in use by the bulk power supply.

In one construction one or more of the two or more common mode and/or differential mode signal injection and/or signal detection points can be disposed actually within any of the hardware carried on the board.

The invention also includes a modular fieldbus board provided with a diagnostic system as described above.

Therefore, the invention also includes a modular fieldbus board comprising a number of fieldbuses connected to a bulk power supply, and a diagnostic system comprising a monitoring transceiver means connected to one or more of the number of fieldbuses by means of two or more common mode and/or differential mode signal injection and/or signal detection points, which points are dispersed between the bulk power supply and the fieldbus trunk, such that the monitoring transceiver means can detect one or more fieldbus physical layer characteristics between two of the two or more of said points.

Preferably each of the one or more fieldbuses can comprise a connection to the bulk power supply, a power supply converter, a power supply conditioner and a fieldbus trunk.

It will be appreciated that the two or more common mode and/or differential mode signal injection and/or signal detection points can be dispersed at any points in the fieldbuses. However, in a preferred construction on each of the one or more fieldbuses a first common mode signal injection and/or signal detection point can be disposed between the bulk power supply and the power supply converter, a second common mode signal injection and/or signal detection point can be disposed between the power supply converter and the power supply conditioner, a third a common mode signal injection and/or signal detection point can be disposed between the power supply conditioner and the field bus trunk, and a differential mode signal injection and/or signal detection point can be disposed between the third common mode signal injection and/or signal detection point and the fieldbus trunk.

In addition, in a preferred construction a fourth common mode signal injection and/or signal detection point can be disposed within the power supply converter, and a fifth common mode signal injection and/or signal detection point can be disposed within the power supply conditioner.

The invention can be performed in various ways, but one embodiment will now be described by way of example and with reference to Figure 1, which shows a diagrammatic display of a modular fieldbus board according to the present invention.

As shown in Figure 1, a modular fieldbus board comprises a backplane 15, on which is mounted any number of fieldbuses 8a, 8b and 8n in series and a monitoring transceiver means 17, (which may also be described by those in the art as a segment autonomous diagnostic system). (The fieldbuses comprise at least fieldbuses 8a and 8b, while 8n diagrammatically signifies any number of further fieldbuses, and is therefore shown in hashed lines.)

The fieldbuses 8a to 8n are connected to bulk power supply 1, and each comprise a power supply converter 3 and a power conditioner 5.

The monitoring transceiver means 17 is provided with a first digital interface, signified by arrow 16, which in use interfaces with a user operated digital control system. Further the monitoring transceiver means 17 is provided with a second digital interface, signified by hashed arrow 19, which in use can interface with similar diagnostic systems provided on associated modular fieldbus boards (not shown).

The monitoring transceiver means 17 is further provided with visual means (signified by arrows 14) which can provide information and warning signals direct to users.

The monitoring transceiver means 17 is connected to each fieldbus 8a to 8n by first common mode signal injection and detection point 2 between the bulk power supply 1 and the power supply converter 3, by second common mode signal injection and signal detection point 4 between the power supply converter 3 and the power supply conditioner 5, by third a common mode signal injection and signal detection point 6 between the power supply conditioner 5 and the field bus trunk (not shown), and by differential mode signal injection and signal detection point 7 between the

third common mode signal injection and signal detection point 6 and the fieldbus trunk (not shown).

In addition, the monitoring transceiver means 17 is connected to each fieldbus by fourth common mode signal injection and signal detection point (not visible, but indicated by connection arrow 9) which is disposed within the power supply converter 3, and by fifth common mode signal injection and signal detection point (again, not visible but indicated by connection arrow 11) disposed within the power supply conditioner 5.

The monitoring transceiver means 17 can monitor for fieldbus physical layer characteristics including over/under termination, noise/ripple level, signal level, signal bias, signal jitter, signal ringing, signal distortion, signal attenuation, cross talk, unbalance, and earth leakage, between any of the above described points.

In addition, the monitoring transceiver means 17 can monitor for voltage, short circuit, hardware module failure, quiescent current, and rate of charge, between any of the above described points.

The monitoring transceiver means 17 is programmed to compile received data in use and produce Fourier analysis, trending analysis, and data logging.

Further, the monitoring transceiver means 17 is programmed to provide an alarm, either via the interfaces 16 or 19, or the visual means 14, in the event that data in use indicates one or more of pre-determined failures or the one or more fieldbuses. The indications of failures in the data are pre-programmed into the transceiver 17.

Thus, the modular fieldbus board can provide many types of information on its performance and on any potential failures to a user.